

Chemistry I Final Exam Review 2013

The final exam will consist of questions from the following units:

Mole Conversions and Stoichiometry, States of Matter (KMT), Behavior of Gases, Solutions, Acids and Redox Reactions

Mole Conversions and Stoichiometry:

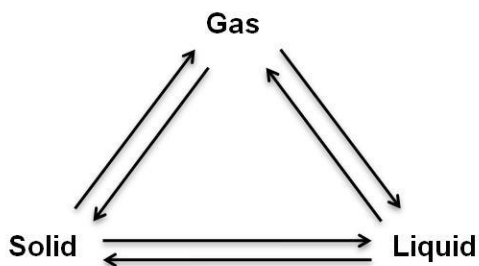
- Determine the number of liters in 1 mole of any gas at STP
- Determine the number of atoms in 1 mole of any substance
- Determine the number of grams in 1 mole of any substance
- Describe the importance of a mole ratio
- Complete one and two step conversions using volume, mass, moles, and atoms (one-step as well as multi-step conversions)
- Given the mass or volume of one component of a chemical reaction, solve for the mass or volume of a second component
- Complete percent yield calculations using the equation below:

States of Matter:

- Describe the five points of the Kinetic Molecular Theory and how they relate to solids, liquids, and gases
- Compare and contrast solids, liquids, and gases in terms of energy, motion, density, shape, volume and compressibility
- Identify all six phase changes and describe what is happening during each change in terms of heat and energy of particles
- Compare and contrast the four types of intermolecular forces (IMF's) in terms of strength and where they are found
- Complete the following table

| | Solid | Liquid | Gas |
|---|-------|--------|-----|
| Definite volume? (Y/N) | | | |
| Fluid? (Y/N) | | | |
| Compressible? (Y/N) | | | |
| Attractive forces between molecules (strong/medium/none) | | | |
| Speed of molecules | | | |

- Water boils at 100 °C while methane (CH₄) boils at -161 °C. Both have similar masses. Explain using KMT why water boils at a higher temperature.
- Where will water boil at a higher temperature – Mount Everest or New Orleans? Explain.
- Label the following diagram:



- Determine the relationship between atmospheric pressure and boiling point
- Define equilibrium, explain under what conditions can it exist, and the processes that are taking place when it does exist
- What does the term dynamic equilibrium mean? Which system is at dynamic equilibrium – a closed water bottle or an open one?

Gases and Their Properties:

- Define STP
- Convert between degree Celsius and Kelvin
- Solve all gas law problems (Boyle, Charles, Guy Lussac, Combined, Ideal)

Solutions:

- Define solute and solvent and differentiate between the two
- Determine which substances will dissolve the fastest (or slowest)
- Describe the various ways to increase the dissolution of a solid in water
- Describe the relationship between temperature and the solubility of gases in water
- Describe the relationship between temperature and the solubility of solids in water
- Differentiate between an electrolyte and non-electrolyte solution
- Determine what substances will dissolve in each other (relate to terms of polarity)
- Calculate the following:
 - Molarity
 - Molality
 - Weight by percent
 - Dilution
- Answer questions using a solubility chart

- Describe how certain solutes will affect the freezing and boiling points of a solvent
- Calculate the freezing and boiling points of solutions

Acids and Bases:

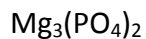
- List the properties of acids and bases
- Describe Arrhenius acids and bases
- Describe Brønsted-Lowry acids and bases
- Differentiate between conjugate acid and conjugate base
- Determine the conjugate acid-base pairs in a chemical reaction
- List the six strong acids and seven strong bases (both names and formulas)
- Differentiate between monoprotic, diprotic, and triprotic
- Calculate pH, pOH, $[H^+]$, and $[OH^-]$ using the given equations
- Determine if a substance is acidic or basic based on its respective pH, pOH, $[H^+]$, or $[OH^-]$
- Describe how the pH scale compares the acidity of any two substances, given their respective pH values
- Determine the products of a neutralization reaction, and solve titration problems
- How can you identify an Arrhenius acid from its formula? An Arrhenius base?

Redox Reactions:

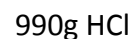
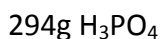
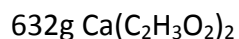
- Assign correct oxidation numbers (charges)
- Define oxidation and reduction
- Identify the oxidation and reduction half reactions

Practice Problems

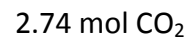
1. Determine the molar mass of the following compounds:



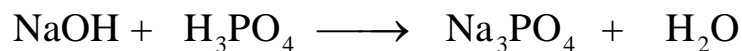
2. Determine the number of moles in each of the following:



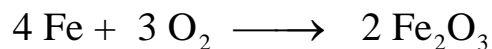
3. Determine the number of representative particles in the following:



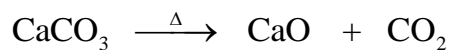
4. Calculate the mass of NaOH is needed to react with 196g of H_3PO_4 in order to produce water and sodium phosphate according to the following **unbalanced** reaction:



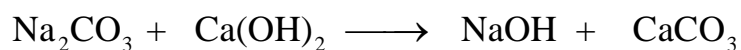
5. Calculate the mass of O_2 that is needed to react with 117 g Fe to make iron (III) oxide?



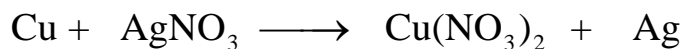
6. Calcium carbonate, CaCO_3 , decomposes and produces 2.26g calcium oxide, CaO . If the theoretical yield is 2.68g, what is the percent yield?



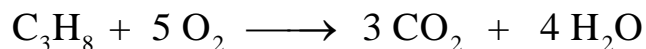
7. Calculate the mass of NaOH produced when 254 grams of Na_2CO_3 are reacted according to the following **unbalanced** reaction:



8. Calculate the mass of Cu needed to produce 2.25 g Ag according to the following **unbalanced** reaction:



9. Calculate the volume of oxygen gas needed to produce 6.5 Liters of CO_2 according to the following reaction:



10. For the following pairs, circle the one in which particles are moving the fastest:

- a. A liquid at 50 °C or A liquid at 100 °C
- b. A solid at 50 °C or A liquid at 50 °C
- c. A solid at 100 °C or A gas at 50 °C
- d. He gas at 30 °C or Kr gas at 30 °C

11. Why is the Kelvin temperature scale more appropriate than the Celcius or Farenheit scales when thinking about KMT?

12. What are STP conditions?

13. The initial temperature of a gas is 43°C. Calculate the final temperature if the volume changes from 500mL to 350mL at constant pressure?

14. Calculate the original volume of a gas at -10°C if the final volume of gas is 200 gallons at 25°C and pressure is held constant?

15. Calculate the final pressure on a balloon if its volume changes from 250 ft³ at 770 mm Hg to 1000 ft³ with constant temperature?

16. A rigid vessel of gas at STP is heated to 900°C. Calculate the new pressure.

17. Underline the solvent in each of the following solutions

- a. A solution containing 10.0 g of glucose ($C_6H_{12}O_6$) and 500.0 g of water
- b. A solution containing 60.0 mL of ethyl alcohol and 30.0 mL of methyl alcohol

18. Complete the following table using the combined gas law:

| Parameter | Initial | Final |
|-------------|-----------|----------|
| Temperature | 23°C | 58°C |
| Volume | 360mL | 150mL |
| Pressure | 230 torr | ? |
| Temperature | Standard | 105°C |
| Volume | 5L | ? |
| Pressure | Standard | 2 atm |
| Temperature | 30°C | Standard |
| Volume | 300mL | ? |
| Pressure | 795 mm Hg | Standard |

19. Why does water not dissolve motor oil?

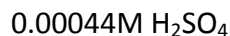
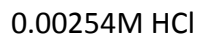
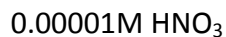
20. In which solution is the solubility of a gas higher – cold water or hot water?

21. What three things can you do to get sugar to dissolve faster in water?

22. When a solute is added to water, what happens to the freezing point? To the boiling point?

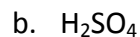
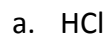
23. Which will freeze at a lower temperature – a 1.5 m solution of NaCl or a 1.5 m solution of MgCl_2 ?
24. Which will boil at a higher temperature – a 1.5 m solution of $\text{C}_6\text{H}_{12}\text{O}_6$ or a 1.5 m solution of NaCl?
25. Calculate the molarity of a solution if 236g of HI is dissolved in 17,500mL of solution?
26. Determine the mass of solute in 2000mL of a 0.25M solution of CuSO_4 .
27. Calculate the molarity of 114g $\text{Al}_2(\text{SO}_4)_3$ in 1500mL of solution.
28. Calculate the weight of KBr needed to make 200g of a 5% solution.
29. Calculate the mass of solute is needed to make 350mL of a 0.1M solution of $\text{C}_2\text{H}_5\text{OH}$.
30. Calculate the molality of a solution in which 115g AlCl_3 in 1500g water.
31. What would be the freezing point and boiling point of the solution in #18

32. Calculate the pH and pOH of the following solutions:

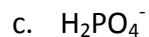
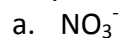


33. Calculate the pOH, hydronium ion, and hydroxide ion concentration for a solution with a pH of 5 and a solution with a pH of 12.35.

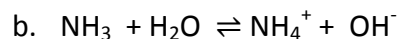
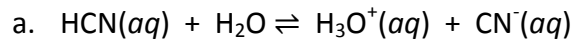
34. Identify the conjugate base for the following:



35. Identify the conjugate acid for the following



36. Label the acid, base, conjugate acid and conjugate base for the following:



37. During a titration process, 35mL of 2.0M H_2SO_4 neutralizes exactly 20.0mL of NaOH.

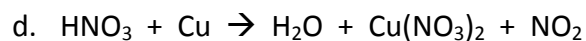
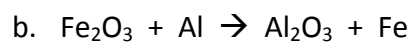
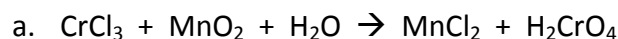
- Predict the products
- Balance the equation
- Label the acid, base and salt
- Name the salt
- Calculate molarity of the base solution.

38. Complete the following for the neutralization reaction between NaOH and HCl.

- Predict the products
- Balance the equation
- Label the acid, base and salt
- Name the salt
- If 15.2 mL of a 1.7 M NaOH solution are needed to neutralize 22 mL of HCl, what is the molarity of the HCl?

39. For the following equations:

- Assign oxidation numbers to all atoms
- Identify which element is oxidized and which is reduced



40. Use the solubility curve chart to answer the following:
- How many grams of $\text{Ce}_2(\text{SO}_4)_3$ will dissolve in 100 g H_2O at 10°C ?
 - How many grams of NaNO_3 will dissolve in 100 g H_2O at 60°C ?
 - How many grams of NH_3 will dissolve in 100 g H_2O at 90°C ?
 - Identify the following solutions as saturated, unsaturated or supersaturated:
 - A solution of KClO_3 at 40°C contains 45 g in 100 g H_2O .
 - A solution of NH_4Cl at 40°C contains 45 g in 100 g H_2O .
 - A solution of KNO_3 at 40°C contains 45 g in 100 g H_2O .
 - How many grams of KNO_3 can be added to 100 g of H_2O if the temperature is increased from 0°C to 60°C ?
 - How many grams of KCl will precipitate out of 100 g of water that is cooled from 80°C to 20°C ?

